CLAIMS

1. A motion compensation method comprising:

interpolating sub-pixels in a reference picture; and

performing motion compensation based on the interpolated reference picture,

wherein said interpolating includes:

a first calculation step of calculating base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a first rounding step of deriving the sub-pixel values of the sub-pixels by rounding the base values calculated in said first calculation step instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said performing of motion compensation includes

performing motion compensation based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.

2. The motion compensation method according to Claim 1,

wherein said first calculation step includes calculating base values of sub-pixels to be interpolated in a first direction, and

said first rounding step includes deriving sub-pixel values of the sub-pixels to be interpolated in the first direction by rounding the base values calculated in said first calculation step.

3. The motion compensation method according to Claim 2,

wherein said interpolation further includes:

a second calculation step of calculating, using the sub-pixel values of the sub-pixels derived in said first rounding step, base values of sub-pixels to be interpolated in

a second direction that is different from the first direction; and

a second rounding step of deriving the sub-pixel values of the sub-pixels to be interpolated in the second direction by rounding the base values calculated in said second calculation step.

4. The motion compensation method according to Claim 3,

wherein said first calculation step includes calculating three base values of a-fourths sub-pixels that are arrayed in the second direction, and

said second calculation step includes calculating three base values of a-fourths sub-pixels that are arrayed in the second direction.

5. The motion compensation method according to Claim 4,

wherein said first calculation step includes calculating the base values of three a-fourths sub-pixels using the following equations when eight pixel values of pixels arrayed in the first direction are represented as A, B, C, D, E, F, G and H respectively and the three a-fourths sub-pixel values are represented as h_1, h_2 and h_3 respectively:

$$h_1 = -1 \cdot A + 3 \cdot B - 10 \cdot C + 59 \cdot D + 18 \cdot E - 6 \cdot F + 1 \cdot G - 0 \cdot H;$$
$$h_2 = -1 \cdot A + 4 \cdot B - 10 \cdot C + 39 \cdot D + 39 \cdot E - 10 \cdot F + 4 \cdot G - 1 \cdot H; \text{ and}$$
$$h_3 = -0 \cdot A + 1 \cdot B - 6 \cdot C + 18 \cdot D + 59 \cdot E - 10 \cdot F + 3 \cdot G - 1 \cdot H.$$

6. The motion compensation method according to Claim 5,

wherein said second calculation step includes calculating the base values of three a-fourths sub-pixels using the following equations when eight pixel values of pixels arrayed in the second direction are represented as D_1, D_2, D_3, D_4, D_5, D_6, D_7 and D_8 respectively and the three a-fourths sub-pixel values are

represented as v_1, v_2 and v_3 respectively:

$$v_1 = -3 \cdot D_1 + 12 \cdot D_2 - 37 \cdot D_3 + 229 \cdot D_4 + 71 \cdot D_5 - 21 \cdot D_6 + 6 \cdot D_7 - 1 \cdot D_8;$$
$$v_2 = -3 \cdot D_1 + 12 \cdot D_2 - 39 \cdot D_3 + 158 \cdot D_4 + 158 \cdot D_5 - 39 \cdot D_6 + 12 \cdot D_7 - 3 \cdot D_8; \textit{and}$$
$$v_3 = -1 \cdot D_1 + 6 \cdot D_2 - 21 \cdot D_3 + 71 \cdot D_4 + 229 \cdot D_5 - 37 \cdot D_6 + 12 \cdot D_7 - 3 \cdot D_8.$$

7. The motion compensation method according to Claim 6,

wherein said first calculation step includes calculating base values of the sub-pixels to be interpolated in a horizontal direction, the horizontal direction being determined as the first direction, and

said second calculation step includes calculating base values of the sub-pixels to be interpolated in a vertical direction, the vertical direction being determined as the second direction.

8. The motion compensation method according to Claim 4, further comprising

a bilinear filtering of raising a sub-pixel accuracy by applying bilinear filtering to the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.

9. The motion compensation method according to Claim 8,

wherein said bilinear filtering includes raising the sub-pixel accuracy of the reference picture from a a-fourths sub-pixel accuracy to an a-eighths sub-pixel accuracy.

10. The motion compensation method according to Claim 1,

wherein said first rounding step includes rounding the base values of the sub-pixels by means of downshifting.

11. The motion compensation method according to Claim 1,

wherein said first calculation step includes calculating base values of sub-pixels that should be arrayed in a horizontal direction and in a vertical direction by multiplying coefficients with pixel

values of pixels included in the reference picture.

12. A motion estimation method comprising:

interpolating sub-pixels in a reference picture; and

performing motion estimation based on the interpolated reference picture,

wherein said interpolating includes:

a calculation step of calculating base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding step of deriving the sub-pixel values of the sub-pixels by rounding the base values calculated in said calculation step instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said performing of motion estimation includes

performing motion estimation based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.

13. A moving picture coding method comprising:

obtaining a picture to be coded;

interpolating sub-pixels in a reference picture;

performing motion compensation based on the interpolated reference picture; and

coding a picture based on the reference picture,

wherein said interpolating includes:

a calculation step of calculating base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding step of deriving the sub-pixel values of the

sub-pixels by rounding the base values calculated in said calculation step instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said performing of motion compensation includes

performing motion compensation of the picture based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values, and

said coding includes

coding a differential between the picture to be coded that has been obtained in said picture obtaining and the reference picture of which motion compensation has been performed in said performing of motion compensation.

14. A moving picture decoding method comprising:

obtaining a differential picture that is a resultant from coding the differential between a picture and another picture;

interpolating sub-pixels in a reference picture;

performing motion compensation based on the interpolated reference picture; and

decoding a coded picture based on a reference picture

wherein said interpolating includes:

a calculation step of calculating base values which are bases of sub-pixel values of sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding step of deriving the sub-pixel values of the sub-pixels by rounding the base values calculated in said calculation step instead of directly using the base values in calculating sub-pixel values of other sub-pixels,

said performing of motion compensation includes

performing motion compensation of the picture based on the reference picture having the interpolated sub-pixels

with the correspondingly derived sub-pixel values, and

said decoding includes

decoding the differential picture obtained in said differential picture obtaining and adding the decoded differential picture to the reference picture of which motion compensation has been performed in said performing of motion compensation.

15. A motion compensation apparatus comprising:

an interpolation unit operable to interpolate sub-pixels in a reference picture; and

a motion compensation unit operable to perform motion compensation based on the interpolated reference picture,

wherein said interpolation unit includes:

a calculation unit operable to calculate base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding unit operable to derive the sub-pixel values of the sub-pixels by rounding the base values calculated by said calculation unit instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said motion compensation unit is operable to perform motion compensation of the picture based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.

16. A motion estimation apparatus comprising:

an interpolation unit operable to interpolate pixels in a reference picture; and

an motion estimation unit operable to perform motion compensation based on the interpolated reference picture,

wherein said interpolation unit includes:

a calculation unit operable to calculate base values which are bases of sub-pixel values of sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding unit operable to derive the sub-pixel values of the sub-pixels by rounding the base values calculated by said calculation unit instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said motion estimation unit is operable to perform motion estimation based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.

17. A moving picture coding apparatus comprising:

a picture obtainment unit operable to obtain the picture to be coded;

an interpolation unit operable to interpolate sub-pixels in a reference picture;

a motion compensation unit operable to perform motion compensation based on the interpolated reference picture; and

a coding unit operable to code a picture based on a reference picture,

wherein said interpolation unit includes:

a calculation unit operable to calculate base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding unit operable to derive the sub-pixel values of the sub-pixels by rounding the base values calculated by said calculation sub-unit instead of directly using the base values in calculating pixel values of other sub-pixels,

said motion compensation unit is operable to perform motion

compensation of the picture based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values, and

said coding unit is operable to code a differential between the picture to be coded that has been obtained by said picture obtainment unit and the reference picture of which motion compensation has been performed by said motion compensation unit.

18. A moving picture decoding apparatus comprising:

a differential picture obtainment unit operable to obtain a differential picture that is a resultant from coding the differential between a picture and another picture;

an interpolation unit operable to interpolate sub-pixels in a reference picture;

a motion compensation unit operable to perform motion compensation based on the interpolated reference picture; and

a decoding unit operable to decode a coded picture based on a reference picture,

wherein said interpolation unit includes:

a calculation unit operable to calculate base values which are bases of sub-pixel values of sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding unit operable to derive the sub-pixel values of the sub-pixels by rounding the base values calculated by said calculation unit instead of directly using the base values in calculating sub-pixel values of other sub-pixels,

said motion compensation unit is operable to perform motion compensation of the picture based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values, and

said decoding unit is operable to decode the differential picture obtained by said differential picture obtainment unit and operable to add the decoded differential picture to the reference picture of which motion compensation has been performed by said motion compensation unit.

19. A motion compensation program for causing a computer to execute interpolating sub-pixels in a reference picture and performing motion compensation based on the interpolated reference picture,

wherein said interpolating includes:

a calculation step of calculating base values which are bases of sub-pixel values of the sub-pixels by multiplying coefficients with pixel values of pixels included in the reference picture; and

a rounding step of rounding the base values of the sub-pixel values calculated in said calculation step instead of directly using the base values in calculating sub-pixel values of other sub-pixels, and

said performing of motion compensation includes

performing motion compensation of the picture based on the reference picture having the interpolated sub-pixels with the correspondingly derived sub-pixel values.